TOWARDS DIGITAL INTERVENTION: OVERVIEW OF DYSCALCULIA IN INDONESIA

Cahyana, Indra Azimi

Abstract— Dyscalculia is a learning disability. It affects the arithmetic ability of student, and usually can’t be separated from mathematical learning difficulty. It is usually occurred in early stage of learning, and unless an intervention (traditional or digital) is given, the disability will persist until adulthood. This paper will present an overview of current condition of dyscalculia in Indonesia. Researches in traditional and digital intervention and the role of computer-assisted instruction are also discussed.

Index Terms— Dyscalculia, Digital intervention, Learning disability, Mathematical learning difficulty, Traditional intervention.

I. INTRODUCTION

Dyscalculia is a kind of learning disability. Learning disability (LD) has several phrases. The Individuals with Disabilities Education Act (IDEA) in America uses the term “Specific Learning Disability (SLD)” whilst DSM states it as “specific learning disorder”. The use of “disorder” describes the term, as learning disability is a disorder, persistent difficulty in reading, writing and doing arithmetic or mathematical reasoning. It can be appeared in listening, thinking, speaking, reading, writing, spelling or doing mathematical calculation. Symptoms may include inaccurate or slow and effortful reading, poor written expression that lacks clarity, difficulties remembering number facts, or inaccurate mathematical reasoning. However, the learning difficulty must not be a result primarily of external factors, such as physical disabilities (vision, hearing or motor), intellectual disability, emotional disturbance or socio-cultural aspects [1].

Thus, LD is different with other disabilities in a sense that it is often mistreated. People with this kind of disability are frequently not seen as disable person, they are perceived as a person who has unexpected academic underachievement, so they don’t get proper treatment in overcoming their problem. As a result, they have continuous difficulty in their daily life. Many of them suffer from low self-esteem, set low goal, struggle with underachievement and underemployment, have few friends and tend to be get a trouble in law [1].

There are three common types of learning disabilities, i.e. dyslexia, dyscalculia and dysgraphia [1] – [3]. Among them, dyslexia is the most well-known one, and as a result, research on dyslexia is leading than other disabilities.

This paper depicts condition of dyiscalculia in Indonesia; its prevalence, what has been done to overcome the disability, as well as researches on this subject. The two types of intervention and the role of computer-assisted instruction are also discussed.

II. DYSCALCULIA IN INDONESIA

Because of their disability, students with LD need special attention. But, their education is not solely responsibility of their teacher. Parents and government, as well as other people in their environment have crucial role. People around them must encourage and support them, giving them a chance to be a part of their community, thus maintain their self-esteem [4]. The government, on the other hand, has an authority to create regulation that can help children overcome their burden in academic.

Indonesian government has taken several steps to protect the right of disable person, especially student, such as:

- Issued the law to support the ratification, such as Undang-Undang No.19 Tahun 2011 and Peraturan Menteri Negara Pemberdayaan Perempuan dan Perlindungan Anak Nomor 10 Tahun 2011 about Policy of Special Needs Children Treatment [3]
- Established Asisten Deputi Penanganan Anak Berkebutuhan Khusus (Assistant Deputy of Special Needs Children Treatment) in August 2010 [3]
- Legalize inclusive school by Peraturan Menteri Pendidikan Nasional Republik Indonesia No. 70 Tahun 2009 about Inclusive Education for Student with Disability and Has Intelligence and/or Special Gifted

As one of learning disability, dyscalculia is often described as an arithmetic disorder. Dyscalculic student usually has difficulty in counting, using mathematical sign (confusing in differentiating +, -, ÷, *), and doing math calculations. Other features of this learning disability including, but not always [2]-[3], [6]-[7]:

- Has difficulty in distinguishing transpose or similar number, such as 9and 6, 17 and 71, 2 and 5, 3and 8.
- Difficulty to differentiate geometric shape.
- Difficulty in understanding abstract concept (such as time and direction).

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- Difficulty in telling time using analogue clock.
- Can’t do or having trouble to do calculation without guidance of aids and problem solving
- Has difficulty in solving word problem.

Dyscalculia usually occurred in childhood. Its prevalence in students worldwide is between 2 – 8% [8] – [10]. Unfortunately, there is no accurate data for the number of dyscalculic student in Indonesia in the recent days. The National Census Survey (Susenas) in 2011 stated that there are 9,957,600 students with disabilities in Indonesia, but it didn’t state the exact number of dyscalculic students [3]. The most comprehensive data about the number of dyscalculic students conducted in 1996 by Center of Research and Development (Balitbang), Ministry of Education and Culture. It arranged a survey to 696 elementary students in four provinces in Indonesia who got low grades in school (below 6.0). The survey found that the students who got low grades were suffered from dysgraphia (71.8%), dyslexia (66.8%) and dyscalculia (62.2%). Furthermore, 33% children had emotional and behaviour disturbance, 31% had speech difficulty, 7.9% were physically disable, 6.6% got malnutrition and health disorder, 6% had visual disorder and 2% had hearing disorder [11]. Other researches about dyscalculia have been conducted in specific region, so its data usually is limited in one city or school.

This paper shows results for some researches about dyscalculia or learning difficulty in mathematics that carried out around Padang region as example. Masroza in 2013 arranged a survey for 24 elementary schools in Pauh Sub district, Padang, to get data about learning difficulty of students there. The result was quite worrisome. Most of the students were indicated as having difficulty in learning mathematic; the number was vary between 30% - 90% of total respondents [12]. Other researches in a school at other sub districts, such as Kapalo Koto, Salido, Pisang Padan, Padang Besi and Jawa Gadut have also been found student with mathematical difficulty, although the prevalence is no as many as in former research [13] – [17].

Although there is no distinguish data for its prevalence, dyscalculia, and other mathematics’ learning difficulties, are undoubted occurred in Indonesia. To help students with this kind of learning difficulty, there are some researches that focus in intervention method, either in traditional or digital way.

### III. TRADITIONAL INTERVENTION

Many researches about intervention in dyscalculia or mathematics’ learning difficulty in Indonesia are focused on traditional one. The researches proposed innovative method to help student in learning math. Some of them use single subject research (SSR) method for they only found one dyscalculic student in their experiment. Table 1 outlines some researches in dyscalculia and math’ learning difficulty in Indonesia.

The result of traditional intervention for student with mathematics’ learning difficulty is not disappointing. In the beginning, the 5th grade student at SDN 05 Kapalo Koto didn’t comprehend the concept of fraction. He couldn’t tell correctly the right fraction of ½, 1/3, and so on. After 16 days of intervention using the CD, he could tell, show, and match the fraction of ½, 1/3, 1/4, 1/6 and 1/8 against its symbol [13]. Utilizing different tools, research at SDN 08 Padang Besi aimed to solve similar fraction problem of student at 3rd grade. Intervention was given in 17 days. The intervention could improve student understanding of simple fraction (1/2, 1/3, ¼, 1,5, 1/6, 1/7, 1/8, 1/9 and 1/10) [15]. Other researches have proposed various methods for various mathematical learning problems, and acquiring good result [16] – [23].

<table>
<thead>
<tr>
<th>No</th>
<th>Location</th>
<th>Method</th>
<th>Subject</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>SDN 05 Kapalo Koto</td>
<td>Using CD to enhance student understanding in simple fraction concept</td>
<td>A 5th grade student</td>
</tr>
<tr>
<td>2</td>
<td>SDN 08 Padang Besi</td>
<td>Utilize puzzle as a media to enhance student understanding of fraction concept</td>
<td>A 3rd grade student</td>
</tr>
<tr>
<td>3</td>
<td>SDN 17 Jawa Gadut</td>
<td>Enhance student ability in summing rows downward by Dienes Block media</td>
<td>A 5th grade student</td>
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<tr>
<td>4</td>
<td>SDN 12 Pisang Padang</td>
<td>Jari Magic method to enhance student ability in multiplication, especially in multiplication by 5</td>
<td>A 5th grade student</td>
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<tr>
<td>5</td>
<td>SDN 14 Koto Panjang</td>
<td>Kotakmatika media to help student understand multiplication</td>
<td>A 4th grade student</td>
</tr>
<tr>
<td>6</td>
<td>SDN 24 Aie Angek Sijunjung</td>
<td>Jarimatika method to enhance student ability in multiplication</td>
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<td>7</td>
<td>Integrated SD Muhammadiyah 1 Besuki</td>
<td>Cooperative Model Think Pair Share method to increase students ability in arithmetic calculation</td>
<td>2nd grade students</td>
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<td>8</td>
<td>SDI Munting Kajang</td>
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<td>9</td>
<td>SDN 20 Tanjung Keramat</td>
<td>Demonstration method to enhance students ability in arithmetical process (sum)</td>
<td>1st grade students</td>
</tr>
<tr>
<td>10</td>
<td>SDN 17 Jawa Gadut</td>
<td>Direct interaction strategy to improve student ability in multiplication rows down operation</td>
<td>4th grade students</td>
</tr>
</tbody>
</table>

Table 1. Location, Method and Subject in Dyscalculia and Math’ Learning Difficulty in Indonesia [13], [15], [16] – [23]

Table 1 has only shown researches of mathematics learning difficulties in elementary school. There are evidences in higher level of education as well, such as a research that conducted at 2nd grade at SMAN 1 Batipuh (Batipuh 1 Senior High School). Fitri et al proposed The Firing Line method, a method that will push student to participate in learning process. She proposed the method because her observation revealed that the students got low mark as well as couldn’t grasp the math lesson due to their lack of motivation and attention in class [24]. Another research was conducted for 8th grade students at SMPN 5 Teluk Keramat, West Kalimantan. It aimed to improve
students’ competency in learning mathematics by using concrete media (real thing media) [25]. Other research was carried out for 8th grade students at MTsN Sigli. The researcher suggested Kumon method to be applied in studying pyramid lesson [26].

Although all researches claimed to be successful in enhancing student ability at mathematics, not all of them are designed for dyscalculic student. Research in SMAN 1 Batipuh, for example, can’t be classified as research in dyscalculia, even though its subjects had difficulty in learning mathematics. The source of learning difficulty in this research came from lack of motivation, which is not a learning disability cause.

IV. DIGITAL INTERVENTION

There are not many researches that focused on digital intervention for dyscalculia. For example, Si Bella, an interactive multimedia learning tools for children with learning disability [36]. Si Bella is a web-based learning tool for 5-7 years old children. Its contents are designed to help children who have difficulty in reading, writing, and counting. It comprises of basic concepts, exercises and games. Since it is an online application, it can be accessed outside schools, so student can try it from their home.

Another research that has been done to help children with learning disability is Sahabat Belajar [37] which is a web-based interactive learning application, include the material for dyslexia, dysgraphia, and dyscalculia.

Research in 1st grade SDN 1 Tangkul Kulon proved that application of PAKEM approach (Active, Creative, Effective and Fun) in learning mathematics with interactive media can improve 20.4% skills of teachers, increase 16.6% student activity, and improve 58.33% student learning outcomes [29].

Research held in 10th grade SMAN Rambipuji aims to develop e-learning site for trigonometry with LMS Moodle based on investigation approach and assisted-learning. The research development refers to 4D Thiagarajan models. The result shows that the learning instruments qualify validity, practical, and effective criteria [30].

Research held in 7th grade SMPN 2 Tanggul using Cooperative Learning with technique “Kancing Gemerincing” with Facebook. Using class action research (CAR) with qualitative and quantitative approach, the result of this research shows there are increasing in students’ activities, students’ learning result completeness, and students' reserve power [31].

Research held in 6th grade SDN 27 Pontianak Utara using classroom action research, quantitative approach and descriptive data analysis shows that using Microsoft Office Power Point learning media to teach about mathematics is able to improve the students’ learning ability by 21.25% [32].

Similar research at 5th grade SDN 3 Pontianak Selatan using descriptive method shows that using Microsoft Office Power Point learning media to teach about mathematics is able to improve the students’ learning ability by 20.81% [33].

Research held in 5th grade SDN 2 Anjongan using true experimental design and quantitative approach shows that classes taught using interactive multimedia shows an understanding of learning relatively higher than those classes that do not [34].

Research held in 5th grade SDN 21 Mempawah Hilir using descriptive qualitative approach shows that the using of interactive compact disc could increase the students’ reasoning capability in Mathematics [35].

V. CONCLUSION

Dyscalculia, when occurred in childhood, will last until adulthood [27] – [28]. Thus, dyscalculic children must get a proper treatment, and the sooner they get the intervention, the better the result of the intervention. There are two ways in giving intervention for dyscalculic children, traditional – utilize tools in learning process in classroom, and digital – use ICT to help the intervention process.

Many researches have been conducted to enhance students ability in learning mathematics proved that traditional intervention for student with mathematics’ learning difficulty is not disappointing and acquiring good result, as well as digital intervention. However, not all of them are suitable, or carried out for dyscalculic student, because it designed to assist student with mathematics learning difficulty in general.

Since the number of children with learning disability tends to rise [7], it is important to conduct a research on computer-assisted instruction (CAI) in this specific learning disability to ensure its adaptivity and appropriateness with the children.

In addition, to increase its mobility, it is better if the CAI is developed for mobile device, so the children can use it anywhere.

REFERENCES


